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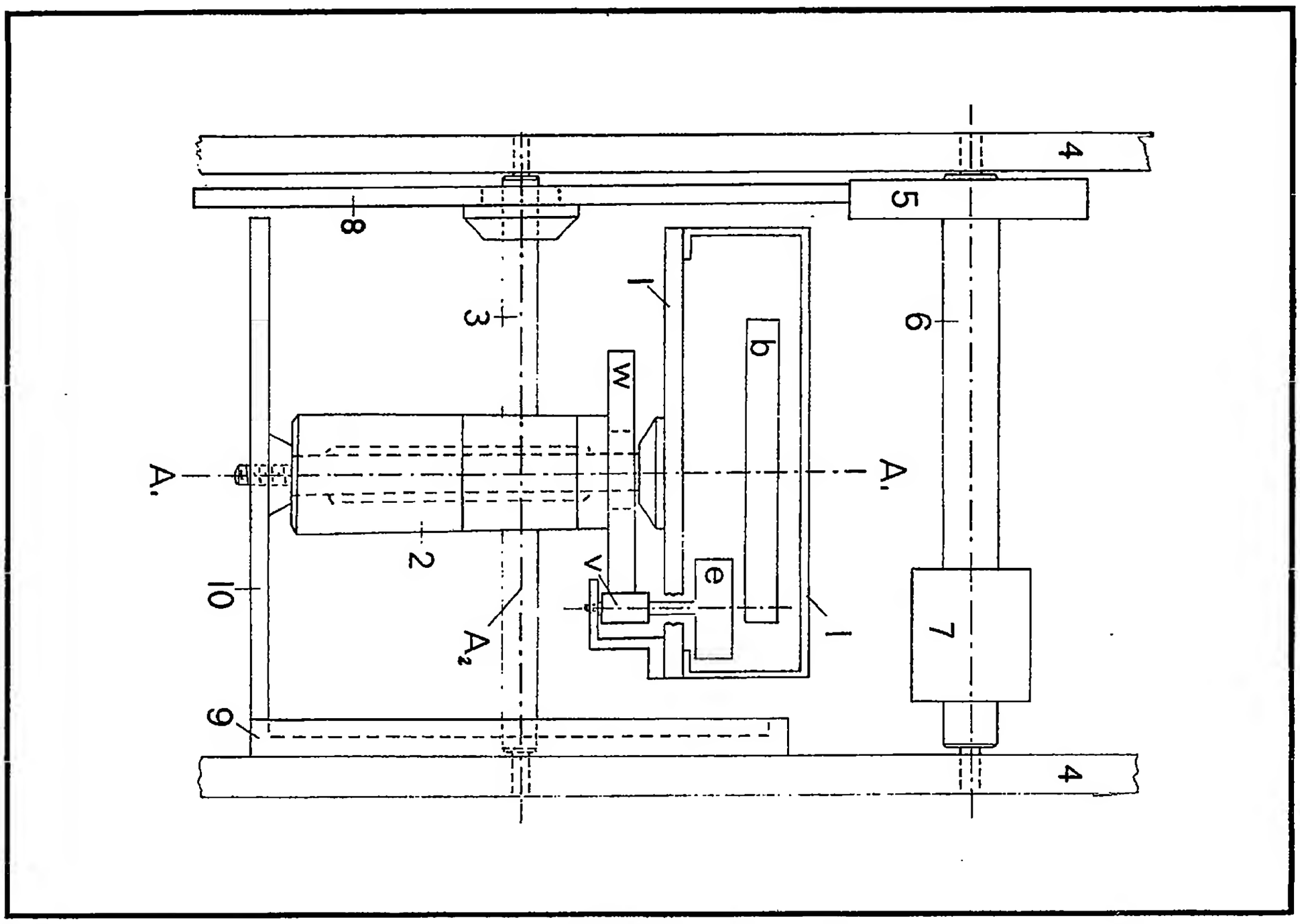
(54) Timepiece with tourbillon

(57) The balance and spring *b*, and the escapement *e*, of a portable mechanical timekeeper are mounted in a frame 1 which is caused to rotate simultaneously about two axes A1, A2 at right angles to each other. As shown the frame is attached to a sheel 10 by means of a shaft which can turn in a tube 2. The tube is fixed to a transverse shaft 3 which is rotated about the axis A2 by means of a wheel 8 fixed to the shaft 3 and meshing with train wheel 5. The wheel 10 meshes with a fixed contrate wheel 9 to turn the frame about the axis A1. A pinion V meshes with a wheel W fixed to the tube 2 and drives the escapement.



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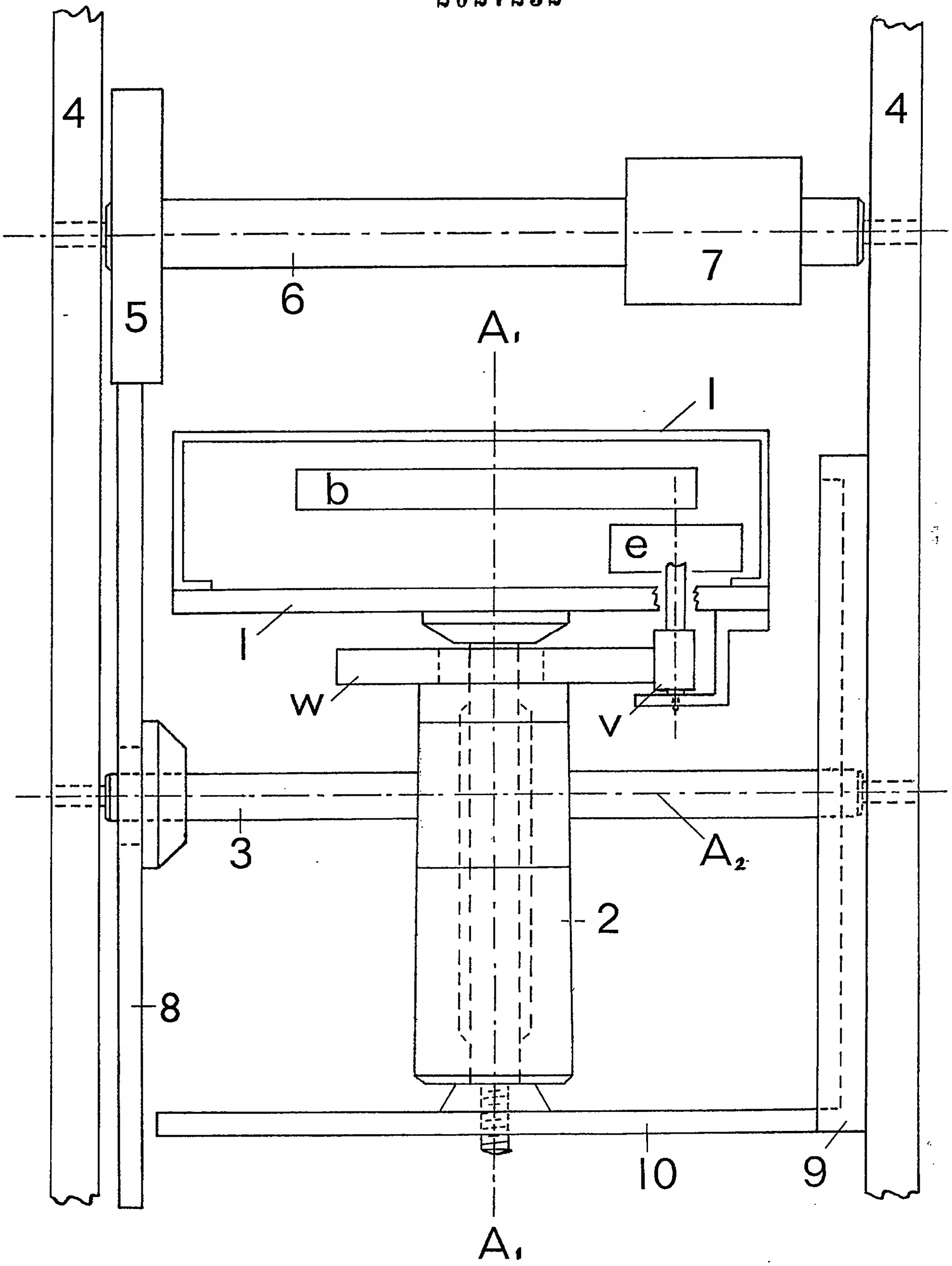

SPECIFICATION

Tumble tourbillon

This invention is to be applied to a portable mechanical timekeeper such as a watch or clock, controlled by a balance and spring oscillator. Its purpose is to eliminate the effects of gravity acting on the oscillator as happens in a conventional design in which both the escapement and oscillator are fixed within the frame of the movement.

It is not possible to make a balance and spring oscillator in which the centre of gravity of the whole system remains at all times and in all conditions of use coincident with the axis of rotation. As a result the period of oscillation will vary depending on the extent to which the centre of gravity of the oscillator is removed from the centre of rotation, and on the position of the oscillator in relation to the external gravitational field to which it is exposed.

To date the only way of reducing this gravitational error has been by the expenditure of a great deal of time, effort and care in the construction of the balance and spring system. Alternatively, the balance and spring system and its associated escapement have been mounted on a separate plate within the movement, and caused to rotate about the major axis of this plate. The latter method is successful if the plane of the plate remains vertical, but variations occur if the plane of the plate is other than vertical.

In this invention the oscillator is mounted within a framework, and this framework is caused to rotate about two axes at right angles, at the same time. Variations due both to gravity and to friction caused by gravity are thus caused to constantly average out, so that the resultant is zero.

The invention is shown in elevation in the diagram. A light framework, *1*, contains an escapement, *e*, and a balance and spring system, *b*, suitably mounted, and rotates about its own central axis, A_1. Bearings for *1* are provided in the tube *2* carried on the shaft *3*. Shaft *3* is provided with suitable bearings in the main plates, 4. The drive for the whole mechanism is provided by the toothed pinion *5* carried on the shaft *6*, itself driven by the pinion *7* in the usual way by a suitable mainspring and reduction gears carrying the hands.

The pinion *5* meshes with and drives the toothed wheel *8*, mounted on shaft *3*, and causes *3* to rotate about its own axis, A_2, A fixed contrate wheel, *9*, is in mesh with the toothed wheel *10*. Due to the rotation of the shaft, *3*, the wheel *10* moves around the wheel *9*. This causes *10* to turn, and with it the framework *1*. A toothed wheel *W*, fixed to *2*, meshes with a pinion *V* pivoted in *1*, and this imparts motion to drive the escapement and thus maintain the oscillations of the balance.

By suitable choice of numbers of teeth of the gear wheels and pinions, *1* and *3* can be made to rotate at any desired speed. *1* and *3* need not rotate at the same speed.

Any suitable escapement and balance and spring system can be used.

CLAIMS

1. Elimination of errors of rate of a mechanical clock, watch or other portable timekeeper controlled by a balance and spring, caused by the earth's or other gravitational and magnetic fields, when the timekeeper is placed in different positions in relation to those fields.

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